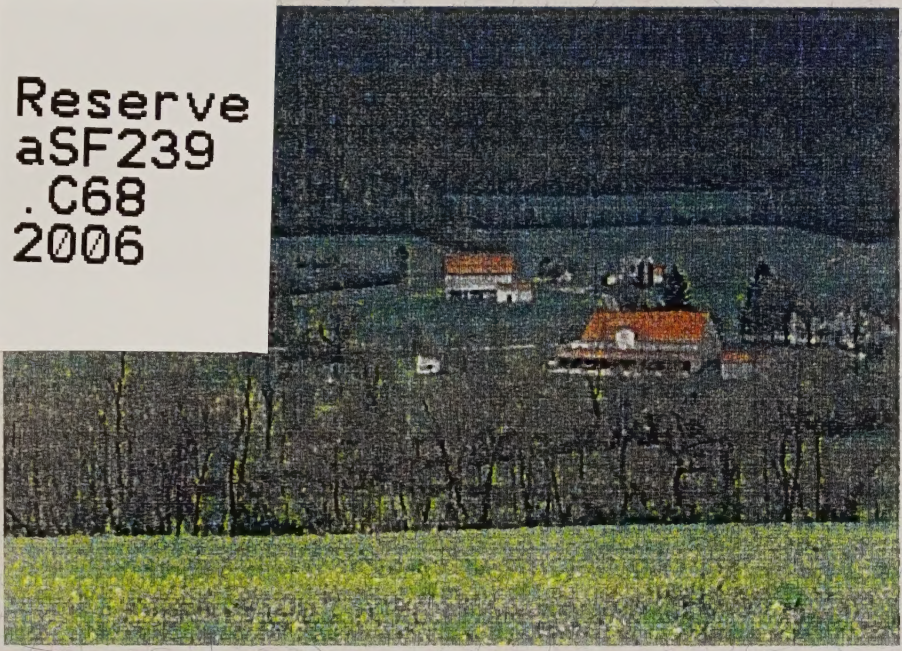
COVE MOUNTAIN FARM:

GRASS BASED DAIRY FARMING FOR THE NORTHEAST

USDA-ARS
Pasture Systems and Watershed Management
Research Laboratory
University Park, PA



Landscape of Cove Mountain Farm is typical of Northeastern farms.

INTRODUCTION

Cove Mountain Farm (CMF) in south central Pennsylvania presents a unique opportunity to holistically quantify the environmental, economic and ecological impacts of grass based dairy farming on a working farm. These components have not previously been evaluated on a whole farm basis. For example, the various components of environmental impact (N leaching, denitrification, P runoff, nutrient uptake) have been studied in separate experiments, or in experiments containing a limited number of these components in highly controlled research farm settings. Furthermore, environmental, ecological and economic impacts have not been evaluated within the same experiment. The purpose of the CMF is determine the environmental, ecological and economic impacts of grass based dairy farming and the resulting interaction of these impacts within the context of operating for-profit dairy farm and to extend the findings to agricultural professionals for further dissemination to the farmers and other decision makers in rural communities.

PARTNER ORGANIZATIONS

- **American Farmland Trust**
- **USDA / Agricultural Research Service**
- **The Pennsylvania State University**
- **Pennsylvania Association For Sustainable Agriculture**
- **USDA / Natural Resources Conservation Service**

STATUS

The **American Farmland Trust** received title to CMF in 1996 from the estate of the late Anthony Wayne Smith with the intent to use the farm for the demonstration and research of grass based dairy farming. Since the acquisition of CMF, **American Farmland Trust** has recruited an experienced grass based dairy farmer as a tenant, started construction of New Zealand style seasonal milking parlor, and entered in to a research agreement with the **Pasture Systems and Watershed Management Laboratory of the Agricultural Research Service (ARS) of the USDA**. As a result of the research agreement soil fertility and plant species inventories have begun and the first phase of an environmental monitoring system has been installed. A meteorological station was installed to measure temperature, precipitation, wind speed, radiation, and evaporation. A tile drainage field and wells, and water samplers and flumes were installed to measure nitrate leaching. Water samplers and flumes were installed to measure phosphorus losses in surface water.

Collection of baseline surface water quality data was started in the fall of 1996. Collection of baseline leachate quality data was started in the fall of 1997. It is anticipated that the farm will be in full production starting with the grazing season in 1998.

RATIONALE AND SIGNIFICANCE

<u>Economic Impacts</u>
Grass-based dairy farming has long been the mainstay of the dairy industry in the temperate maritime regions of the world such as the United Kingdom, Ireland, and New Zealand. For several reasons this method of dairy

WQ: Dairy

Ecological studies to determine the impact of grazing on plant species.

production has recently gained acceptance among a significant number of small to medium sized dairy farms in the Northeast. First and foremost, there are numerous studies that indicate that dairy farm profitability can be increased by $50 to $200/cow/year. This increased profitability, a benefit to both farmers and rural communities, arises mainly from decreases in production costs associated with planting, harvest and storage of row crops and stored forage and decreased costs of manure storage and hauling. Secondly, many farmers find that they have a better quality of life because grass based dairy farming provides for increased flexibility in time management resulting in decreased work loads. This is particularly true during the times of the year when planting and harvesting of annual grain and forage crops such as corn compete with the time required for milking and other animal management tasks. Finally, because grass-based dairy farms often do not grow row-crops, soil erosion, fertilizer and pesticide runoff can be greatly reduced.

Environmental Impacts

Nitrogen. While grass-based farming can increase farm profitability, improve the quality of life for small to medium sized dairy farmers and reduce soil erosion and pesticide use, it is not without potential problems. The largest of these is the problem of nitrate leaching from the practice of Management Intensive Rotational Grazing (MIRG), the core forage production and harvest practice of grass-based dairy farming. The increased nitrate leaching is largely the result of increased stocking rates and the uneven distribution of urine in

pastures. There is a large body of research in the United Kingdom Europe and New Zealand and an emerging body of research in the Northeast indicating that there is a large amount of nitrate leached from urine in pastures. This nitrate can have a significant negative impact on the quality of water draining from pastures. What is not known, however, is the extent to which the nitrate leached from urine interacts with biological processes such as denitrification, physical processes such as subsurface flow, and the overall management of the farm to affect water quality at the landscape or farm scale.

Phosphorus. In the Chesapeake Basin, livestock manure is a major P source on farms. Because manure has a higher P:N ratio than that needed by plants and is applied based on its N content, amounts of P added via manure often exceed crop requirements. Thus a major buildup of P in soils has resulted, which has increased the potential for P enrichment of runoff.

There is a substantial body of work on the relationship between soil P and P levels in runoff at point or plot scales. Extension of this knowledge to farm or watershed scales becomes problematic (but critical to the issue of nutrient management), as we begin to recognize that the spatially variable P sources and transport processes are linked by the watershed-scale flow system. Further, a comprehensive P management strategy must address down-gradient water quality impacts because this is where the impact of land management will be assessed. Such a strategy must link effects at the local scale (i.e., the field) where specific management practices are implemented, with the scale of the management unit (i.e., the farm), and with the larger scales at which impacts are evaluated (i.e., the watershed). Most of these impacts have been investigated for cropped systems, with little information evaluating the pathways and quantifying the losses of P from pastures. With the increased interest in adoption of grazing-based dairying in the Northeast, more information is needed on the impact of pasture and livestock management on processes controlling P export in runoff.

Ecological Impacts

Grasslands. Grassland ecology is concerned primarily with those factors influencing the composition of plant species under grazing particularly as to how it relates to sustaining productive plant communities. With the

recent trend of livestock operations opting for less capital-intensive production systems, more emphasis has been placed on inexpensive pasture systems that rely on complex species mixtures and tightly coupled nutrient cycling to produce forage. A recent discussion amongst farmers and staff at the Pasture Systems and Watershed Management Research Laboratory revealed that farmers are planting complex mixtures of grasses and legumes with up to six to seven species in the mix. However, the productivity, species diversity, and stability of species presence in the resulting mixtures have not been determined. Thus, knowledge of the key control points and mechanisms regulating the presence and stability of species in pasture plant communities is vital. Grazing may be expected to change the botanical composition and diversity of these grasslands because of animal treading, selective grazing of plant species, and differences in nutrient cycling caused by the grazing animal excreting more readily available forms of N and P in urine and feces.

A common challenge for farmers grazing dairy cows is accurately estimating both the quantity and quality of herbage available in paddocks during the season. Accurate estimates are needed so that the producer may effectively budget forage and strategically supplement cows on pasture to ensure a relatively uniform animal productivity during the season. Animal productivity in a grazing system is a function of the output per animal (e.g. milk per cow, gain per head; a measure of forage quality) and the number of animals that a unit of grazing land will support. Voluntary dry matter intake along with stocking rate are key determinants of animal performance on pasture. Dry matter intake is strongly affected by the amount of herbage on offer and its accessibility and acceptability. The amount of herbage grown and consumed is affected by the botanical composition and population of the pastures along with the morphology and structure of the sward.

Parasites. Gastrointestinal parasites are responsible for extensive losses by the American Dairy and Beef industries. Nematode infections are estimated to cost the industries in excess a $1-2 billion dollars for year, and in addition, the industries have been forced to deal with the public perception that cattle are a major source of contamination of water supplies with the protozoan parasite *Cryptosporidium parvum*. Efficient sustainable cattle raising operations must address both the

Flumes continuously measure streamflow and automatically collect samples during storms.

economic challenges posed by the parasites, and the issue of potential spread of zoonotic disease to water systems. Many of the current recommendations are geared to larger operations that are less-adaptable to the concept of sustainable agricultural systems.

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